

Learning in practice

Cohort study of examination performance of undergraduate medical students learning in community settings

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Abstract

Objectives To determine whether moving clinical medical education out of the tertiary hospital into a community setting compromises academic standards.

Design Cohort study.

Setting Flinders University four year graduate entry medical course. In their third year, students are able to choose to study at the tertiary teaching hospital in Adelaide, in rural general practices, or at Royal Darwin Hospital, a regional secondary referral hospital.

Participants All 371 medical students who did their year 3 study from 1998-2002.

Main outcome measures Mean student examination score (%) at the end of year 3.

Results The unadjusted mean year 3 scores at each location differed significantly ($P < 0.001$); the mean score was 65.2 (SE = 0.43) for Adelaide students, 68.2 (0.83) for Darwin students, and 69.3 (0.97) for students on the rural programme. Mean year 2 scores were similar for each location. Post hoc tests of means adjusted for sex, age, year 2 score, and cohort year showed that the rural and Darwin groups had a significantly improved score in year 3 compared with the Adelaide group (adjusted mean difference = 3.08, 95% confidence interval 1.25 to 4.90, $P < 0.001$ for rural group; 1.91, 0.47 to 3.36, $P = 0.001$ for Darwin group).

Conclusions These findings show that the concern that student academic performance in the tertiary hospital would be better than that of students in the regional hospital and community settings is not justified. This challenges the orthodoxy of a tertiary hospital education being the gold standard for undergraduate medical students.

Topic: 132; 366

Introduction

Undergraduate medical education is increasingly being transferred out of tertiary hospitals into community settings despite scant evidence of the effect this has on academic performance.¹⁻³ A Medline search with the key words "undergraduate, medical education, tertiary, community, comparison" produced only one

reference, a description of the programme on which this paper is based. This lack of evidence leaves community based medical education open to the attack of being a fad, driven by idealists who are prepared to compromise academic standards for their social agendas.⁴ In this study, we examined whether academic standards at our institution were compromised by moving medical education out of the tertiary hospital.

Background

Flinders University delivers a four year graduate entry medical curriculum using problem based learning as the main method of instruction.⁵ The first two years of the course are predominantly taught in small group tutorials and the last two years almost entirely in clinical settings. The main clinical examination occurs at the end of the third year.

During year 3, all students study medicine, surgery, paediatrics, women's health, general practice, and liaison psychiatry. At the 500 bed urban university tertiary teaching hospital in Adelaide, the students learn each discipline in sequential rotations, with the exception of liaison psychiatry, which is integrated throughout the year.

In 1997, the school piloted an innovative community based option for year 3 students, the parallel rural community curriculum.⁶ The curriculum enables up to eight students a year to do their entire year 3 studies based in small (four to eight doctors) rural general practices in the Riverland region of South Australia, 250 km from Adelaide. In 2002, a further eight places were made available in the Greater Green Triangle region of south eastern South Australia and western Victoria. This programme was developed with the help of the Commonwealth Department of Health and Aging as part of a long term strategy to tackle the shortage of doctors in rural Australia.

In 1998, the school started teaching the year 3 curriculum at Royal Darwin Hospital, a 200 bed regional secondary referral hospital 3000 km from Adelaide in the tropical north of the country. This hospital had previously managed short term elective teaching for medical students from several medical schools but had not been seen as a teaching hospital or had academic staff. Up to 16 students a year do all their year 3 study

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Table 1 Sex, age, and cohort year of students by place of study. Values are numbers (%) of students

	Adelaide (n=263)	Rural community programme (n=40)	Darwin (n=68)	Overall (n=371)	P value
Sex:					
Male	159 (60)	17 (43)	37 (54)	213 (57)	0.083
Female	104 (40)	23 (58)	31 (46)	158 (43)	
Age (years):					
<24	89 (34)	12 (30)	26 (38)	127 (34)	0.543
25-29	112 (43)	14 (35)	27 (40)	153 (41)	
30-34	33 (13)	5 (13)	7 (10)	45 (12)	
≥35	29 (11)	9 (23)	8 (12)	46 (12)	
Year					
1998	47 (18)	6 (15)	10 (15)	63 (17)	0.760
1999	55 (21)	6 (15)	14 (21)	75 (20)	
2000	48 (18)	7 (18)	15 (22)	70 (19)	
2001	53 (20)	6 (15)	13 (19)	72 (19)	
2002	60 (23)	15 (38)	16 (24)	91 (25)	

Table 2 Mean examination scores by year and location of study in year 3

Year	Mean (SE) score (%)			P value
	Adelaide	Rural programme	Darwin	
Year 2	65.1 (0.3)	65.4 (0.7)	66.5 (0.6)	0.1751
Year 3	65.2 (0.4)	69.3 (1.0)	68.2 (0.8)	0.0001

in Darwin. This opportunity has been made possible by the support of the Northern Territory government.

The separate governmental assistance to the two programmes has enabled them to develop without having to rely on funds from the tertiary centre. Most of the funding, however, has come from money allocated to pay for teaching for local general practitioners and specialists. In the tertiary centre, the course is usually funded through teaching hospital funds and university operating grants. As the number of students at the tertiary centre is now smaller, both the rural communities and the tertiary hospital have gained financially. The level of resources for each student is similar for all of the programmes despite the different sources of funds.

Methods

All students (70-90 a year) did their first two years of medical study at Flinders Medical Centre. Students were then able to apply to the Darwin or rural community programmes. As there were usually more applicants than places, we selected students on the basis of an autobiographical statement and interview, with an emphasis on their intention for future practice

in a rural or remote setting. Academic results for year 2 were not available at the time of selection.

At the end of year 3, all students sat an identical clinical examination consisting of written multiple choice questions, extended matching questions, modified essay questions, mini-case written papers, and a comprehensive objective structured clinical examination.

We included all students who did their year 3 study in 1998-2002. The main outcome measure was examination score (%) in year 3. We tested differences between locations by sex, age, and cohort year using exact χ^2 tests and differences by examination score in year 2 and year 3 using one way analysis of variance. We used analysis of covariance to compare the mean score in year 3 between locations after adjusting for covariates. Covariates included score in year 2, sex, age, and cohort year. The cohort year was first converted to four dummy variables, each representing a comparison between a given year and 1998. We also did a Dunn-Sidak post hoc comparison of adjusted means. We used the Stata 8.0 package for statistical analyses.

Results

There were 371 students included in the study. Table 1 shows the sex, age, and cohort year by location. None of these variables differed significantly by location. Mean score for year 2 scores were similar for each location, but mean scores for year 3 differed significantly (table 2).

Table 3 shows the results of the analysis of covariance. The model accounted for 61% of the variance in year 3 score. In particular, there was a highly significant difference in year 3 score by location after we had adjusted for covariates.

The Dunn-Sidak post hoc tests found that the rural programme group had a significantly improved score in year 3 over the Adelaide group (adjusted mean difference = 3.08, 95% confidence interval 1.25 to 4.90; $P < 0.001$). The Darwin group also had a significantly better score in year 3 than the Adelaide group (adjusted mean difference = 1.91, 95% confidence interval 0.47 to 3.36; $P = 0.001$).

Discussion

We know of no other studies directly comparing the academic performance of students learning the same curriculum in tertiary, secondary, or primary care settings. Examination performance is only a proxy for academic performance, but it is the most common measure used by universities to determine academic progression, is used by many hospitals in ranking applicants for junior doctor positions, and is a measure that students value highly.

We did not use randomization in this study. This is a common problem in educational settings, introducing the possibility of biases, including selection bias.⁷ It could be argued that the students who were selected for the rural and remote settings were, for example, more resourceful and talented. If this were so, it would have been evident in their previous academic performance because the first two years' study, based entirely on problem based learning, encourages and rewards

Table 3 Analysis of covariance of year 3 score by location

Source of variation	Sum of squares	Degrees of freedom	Mean square	F ratio	P value
Model	11 363	9	1263	65.3	<0.001
Year 2 score	5 535	1	5535	286.1	<0.001
Age	190	1	190	9.8	0.002
Sex	15	1	15	0.8	0.377
1999 v 1998	1 172	1	1172	60.6	<0.001
2000 v 1998	430	1	430	22.2	<0.001
2001 v 1998	67	1	67	3.4	0.064
2002 v 1998	432	1	432	22.4	<0.001
Location	442	2	221	11.4	<0.001
Residual	6 984	361	19	—	—
Total	18 347	370	—	—	—

these qualities. However, we saw no differences in previous academic performance by group (table 2).

A further argument against selection bias being a serious limitation in this study is the school's selection procedure. The three elements that contribute to this process are performance in a national admission test of reasoning and problem solving in the basic sciences and humanities, performance in a previous undergraduate degree, and performance at a standardised interview that rewards evidence of self directedness, teamwork, communication skills, compassion, resourcefulness, and broad life skills. Thus, all medical students at Flinders are likely to be resourceful and talented high achievers.

Other qualities that could be over-represented in students in the rural programme and Darwin groups, such as seeking adventure, interest in rural medicine as a career, being suited to rural life, and having fewer ties with the city, show only the student centred benefits of offering different environments to suit the needs of different students. There is no suggestion that such qualities inherently affect academic performance, but when a student's self perceived traits are matched to an environment that supports them, their academic performance may be enhanced. This should, however, have been equally true for students who chose to study in the tertiary centre.

Our analysis accounted for the other possible biases of student age, sex, year 2 score, and cohort effect. The results cannot be explained by the Hawthorne effect as they have been sustained over five years and during this time the rural and Darwin programmes have become a routine part of the school's study options. The results may also be criticised for reflecting the effect of group size rather than location. However, on a day to day basis, students in all of the locations were allocated to practices or wards in pairs or alone, and tutorial group sizes were also similar.

Future of community learning

When the rural and Darwin programmes were initiated, the university had some concerns that student learning would be compromised in pursuit of the longer term workforce aims. The quality of the students' examination performance in the regional hospital, and, in particular, in the community setting, has allayed this concern. Our findings challenge the orthodoxy of a tertiary hospital being the most appropriate location for all undergraduate medical students.

In 2001, the Australian Commonwealth government announced a national programme that will require each medical school to enable a quarter of its students to undertake half of their clinical education in rural or remote settings. Although some students will learn better in large urban settings, our findings should give students confidence that they do not have to sacrifice academic performance when taking advantage of such learning opportunities.

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Competing interests: None declared.

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Corrections and clarifications

Coronary heart disease prevention: insights from modelling incremental cost effectiveness

Our complex ELPS (electronic long, paper short) system got the better of us in this paper by Tom Marshall (*BMJ* 2003;327:1264-7). In the full (bmj.com) version, the figure shows the average cost effectiveness of preventive treatments based on a patient at 10% risk [not 10.5% risk, as stated in the caption] of a coronary event over five years. The value was correct in the abridged version (both in print and on bmj.com).

Meadow faces GMC over evidence given in child death cases

A statement in this News article by Owen Dyer about a new working party set up to produce a national protocol for investigating sudden infant deaths was wrong (3 January, p 9; doi:10.1136/bmj.328.7430.9). The working party was not set up by the government. It was set up jointly by the Royal College of Pathologists and the Royal College of Paediatrics and Child Health, although the Department of Health is represented on it.

Obituary

In this obituary of Allan J Erslev by Janice Hopkins Tanne (3 January, p 52; doi:10.1136/bmj.328.7430.52), we should have said that Dr Sandor S Shapiro [not Jaime Caro] succeeded Dr Erslev as director of the Cardeza Foundation for Hematologic Research at Jefferson Medical College of Thomas Jefferson University in Philadelphia, Pennsylvania. Dr Shapiro gave up that position in 2000 and is now research professor of physiology at the college.

Medscape conference coverage

13th Annual Congress of the European Respiratory Society (ERS)

- Asthma
- COPD

• Idiopathic Pulmonary Fibrosis
Coverage of these sessions is available, free, on the *BMJ's* website: http://www.bmj.bmjjournals.com/medscape/respiratory_medicine/ers1/

What the educators are saying

Workplace assessment is imprecise

For those involved in assessing clinical competence in the workplace, a review in *Teaching and Learning on bias in rating clinical performance* is a "must read." Raters, the review says, form limited general impressions based on assessment of one or two dimensions, such as "clinical skills" and "professional behaviour." Standards are idiosyncratic. Positive assessments of professional behaviour are reported more extensively than negative ones, leading to overgenerous evaluations. Training unfortunately has little impact on improving the accuracy and reproducibility of ratings. The conclusion seems clear. Traditional observation in the workplace is not a robust way to assess a doctor's competence to practise. It must be supplemented with other more objective structured clinical examinations.

Teaching and Learning in Medicine 2003;15:270-92

Racism in medical schools must be tackled

Internationally the student body is becoming increasingly diverse. Undergraduate entries in many countries are now dominated by women as white men elect different career pathways. With the rising percentage of ethnic minority students in the United Kingdom, issues of racism, intentional or unintentional, are unfortunately apparent. A qualitative study from Canada increases our understanding of these experiences, which are more often subtle, relating to unintentional comments or racist jokes, rather than blatant. As educators we need to emphasise antiracism, uphold values of equality and equity, and tackle issues of power and privilege in our institutions.

Medical Education 2003;37:852-60

Humanities have a place in medical education

Over the past few years, studying arts and humanities has been seen to have value in undergraduate medical education, particularly in developing professional attitudes and behaviours. *Medical Education* now has a regular section devoted to this. In addition, a recent issue of *Academic Medicine* has humanities education as a special theme.

Programmes from more than 40 medical schools are published. Creative arts projects are widely used to link actively with emotional aspects of medicine, whereas a specific work such as Ibsen's play *An Enemy of the People* can teach communication of scientific knowledge.

Academic Medicine 2003;78: 951-1058

Learning through simulation



Simulation has become increasingly popular as a method for learning clinical skills. It was originally used in aviation to train flight crews, and now a wide range of medical simulations is being developed. These include artificial mannequins, virtual computer imaging, and professional live role play. Medical Education has produced a supplement devoted to simulation in clinical learning, and the next ASME meeting in February ("Simulation in Medical Education") will provide a forum to exchange ideas. Visit the website of the Association for the Study of Medical Education (www.asme.org.uk) for details.

Medical Education 2003;37(suppl):1-78

Primary care is set to take a secondary care role

An increasing proportion of undergraduate education is now delivered in primary care. In some medical schools as much as 20% of the undergraduate curriculum is community based, and in Britain more than a third of general practices are involved in teaching medical students. Foreseeing a continuation of this trend, Sir Denis Pereira Gray, past president of the Royal College of General

Practitioners, predicts a total role reversal between primary and secondary care. Curative medicine, he argues in a stimulating editorial, will be provided almost exclusively within primary care. Secondary care will become a "a repair factory for pensioners" where activity will focus on routine replacement of body organs. If he is correct, medical educators have a challenge on their hands to develop comprehensive new educational programmes.

Medical Education 2003;37:754-5

It's hard to encourage personal learning

A key facet of postgraduate and continuing professional development is being motivated to take responsibility for personal learning and direct it effectively. This is easier said than done. In the University of Toronto, the undergraduate curriculum was revised to focus on small group work using problem based learning supported by lectures and opportunities for self direction. The impact of this change was assessed with two validated questionnaires. Neither identified any positive effects of the curriculum on self directed learning.

Academic Medicine 2003;78:1259-65

"Professionalism" needs to be more clearly understood

Whether it's accountancy, architecture, dentistry, engineering, the law, or medicine, all professions face the same problems when measuring professional attributes. This key message emerged from the Cambridge Conference Workshop meeting on interprofessional education held in Cambridge in October. Delegates shared issues related to delivering effective, defensible assessment procedures and agreed that the widespread move towards work based assessment was failing to produce defensible solutions. Better understanding of "professional behaviour" is needed before we can reliably assess it.

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